CLAIMS

1. A modulator, comprising:

an adder configured to combine a first continuous-time signal and a binary output signal to form a first intermediate signal;

an integrator operably coupled to the adder and configured to receive the first intermediate signal and generate a second intermediate signal therefrom,

a bistable device operably coupled to the integrator and configured to receive the second intermediate signal, and generate the binary output signal therefrom, and

a feedback loop coupling the bistable device and the adder to provide the binary output signal to the adder.

2. The modulator of claim 1, wherein the modulator is an all-electronic device.

3. The modulator of claim 1, wherein the modulator is an all-optical device.

4. The modulator of claim 1, wherein the integrator is a leaky integrator.

5. The modulator of claim 4, wherein the integrator has a transfer function of $\frac{g}{s+1/\tau}$ where g is the gain coefficient and τ is a finite period of time.

6. The modulator of claim 5, wherein g and τ are selected so that the first intermediate signal will always be a non-negative value.

7. The modulator of claim 5, wherein the bistable device is an inverted bistable switch.

8. The modulator of claim 1, wherein the bistable device is an inverted bistable switch.

9. A system, comprising the modulator of claim 1, and a computing device coupled to the modulator and being configured to adaptively modify parameters of the modulator to optimize performance.

10. The system of claim 8, wherein the computing device is configured to modify at least one of sampling frequency and input signal range.

11. The modulator of claim 1, further comprising at least one multi-level bistable device.

12. The modulator of claim 1, wherein the feedback loop includes a delay.

13. A method for converting a continuous time signal to a binary signal, comprising the steps of:

receiving a continuous time signal,

adding a binary signal to the continuous time signal to produce a first intermediate signal,

processing the first intermediate signal through a leaky integrator to produce a second intermediately signal, and

processing the second intermediate signal through a bistable device to produce the binary signal.

14. The method of claim 13, further comprising the step of modulating a light signal with the continuous time signal.

15. The method of claim 13, further comprising the step of adaptively adjusting at least one of input signal range and sampling interval.

16. A modulator comprising:

an amplifier configured to amplify a continuous-time signal,

an optical isolator configured to receive a light signal,

a fiber-optic coupler configured to receive the light signal modulated by the continuous-time signal,

a leaky integrator configured to generate an integrated signal from output of the fiber-optic coupler,

a bistable device configured to generate a binary signal from the integrated signal, and

a feedback loop configured to provide continuous operation of the modulator.

17. The modulator of claim 16, wherein the leaky integrator is configured to provide exponential decay of optical density.

18. The modulator of claim 17, wherein the bistable device is a multiple quantum well device.

19. The modulator of claim 16, wherein the amplifier, the optical isolator, the fiber-optic coupler, the leaky integrator, the bistable device, and the feedback loop are contained on a single chip.

20. The modulator of claim 16, further comprising a second leaky integrator coupled to the bistable device.